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The Reentrant Nematic - Smectic-A - Nematic Phase Diagram in a Liquid Crystal Aerosil Dispersion

P.S.Clegg, C.Stock, M.Ramazanoglu, R.J.Birgeneau (U.Toronto), C.W.Garland (MIT)

Beamline(s): X20A, X20C

We have carried out a thorough series of x-ray diffraction studies of 8OCB:6OCB mixtures containing dispersed silica particles (aerosils). Mixtures of these two liquid crystals have a nematic to smectic-A transition below a critical concentration of 6OCB. At low temperatures the smectic-A density wave melts and the liquid crystal reenters the nematic phase. We have studied samples with concentrations either side of the critical concentration and for a range of aerosil densities. From previous studies it is known that the aerosil particles hydrogen bond together to form a very low-density gel. The measurements characterize the smectic fluctuations between 80C and 20C. For all aerosil concentrations the smectic correlations are short range. This shows that the aerosils destroy the smectic state. Below the critical concentration of 6OCB there appears to be a threshold density of aerosil above which the reentrant transition is suppressed. Surprisingly, above the critical concentration it appears that the degree of smectic ordering can be enhanced by the aerosil particles. More detailed data analysis is in progress.